THE CIRCUMSCRIPTION OF *ADIANTUM DIAPHANUM* BLUME (ADIANTACEAE), THE FILMY MAIDENHAIR FERN

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Summary

The circumscription of *Adiantum diaphanum* Blume with respect to *A. setulosum* J. Smith is discussed. It is concluded that the two are conspecific and that the earlier name *A. diaphanum* should be retained. The applicability of frond hairs to the taxonomy of *Adiantum* is reviewed and the conclusion reached that hair morphology is a reliable taxonomic character but that, with few exceptions, location and density of occurrence of hairs on the various frond surfaces are characters of dubious value.

Introduction

Adiantum diaphanum Blume (the accepted name for the filmy maidenhair fern in Australia) is a delicate fern with a widespread distribution in the Malesian-Pacific region. In Australia, it rarely occurs far from water (in some situations it is a seasonally or sporadically inundated rheophyte), commonly growing on rocks or soil along creeks and rivers in closed forest. The taxon occurs along the east coast from Cape York to Victoria and on Norfolk Island. Its extra-Australian distribution encompasses New Zealand, southern China (Hainan), Vietnam, Malesia, Taiwan and Japan; as well, it extends eastward in the Pacific as far as Fiji (Hooker 1858; Brownlie 1969, 1977; Brownsey & Smith-Dodsworth 1989; Pichi Sermolli 1991).

Recently, Price (1987, 1990) reinstated the name *Adiantum setulosum* J. Smith, long considered a synonym of *A. diaphanum*; he restricted the usage of the latter name to Javan plants (which he stated, incorrectly, bear glabrous indusia), and applied the former name to plants from the remainder of the range. I am unhappy with this cavalier treatment of the filmy maidenhair fern, and offer the following arguments in support of the retention of *Adiantum setulosum* J. Smith in the synonymy of *Adiantum diaphanum* Blume.

Discussion

Two interesting morphological features characterise the filmy maidenhair fern. One presumed constant character, which serves to separate this fern from all other species of *Adiantum*, is the proliferous nature of the roots (Brownsey & Smith-Dodsworth 1989, Pichi Sermolli *op. cit.*). Although small tubers similar to those found on the roots of this species also occur on the roots of *A. novae-caledoniae* Keys. (reported by Page 1979), and confirmed by me after examination of herbarium specimens at the National Herbarium of New South Wales (NSW)), *A. diaphanum* is apparently the only species in the genus to form clonal colonies by proliferation from root buds.

The other feature which is diagnostic of *A. diaphanum* is the presence of dark setae between the veins on the lamina of ultimate segments, and the corresponding presence of similar setae on the outer surface of the soral flap (often loosely called 'indusium' or 'false indusium'). The setae are quite rigid, straight or slightly curved, thick-walled, unicellular above the associated, somewhat bulbous, epidermal cell (see Zimmer (1989) for micrographs), and may be quite evenly distributed over the lamina, or confined to the proximal basiscopic portion of the adaxial surface of the pinnule. On rare occasions some setae are present on rachises, which are otherwise normally glabrous. One form of the taxon, moderately well represented among herbarium specimens, has sparsely distributed robust setae on the adaxial lamina surface, but the abaxial lamina surface is best described as hirsute, with a few robust setae intermixed with very numerous shorter and thinner hairs; for example, a mean density of 17 shorter hairs per mm^2, in contrast to a mean density of 0.75 robust setae per mm^2 (*Andrews* 229 & *Dockrill*, BRI, 4 pinnules sampled). Brownsey (1987) indicates that this is the common form of the species in New Zealand.

Previously, Brownsey (1987) reported the presence in New Zealand of colonies of this fern in which all or the majority of plants were glabrous. He appealed (*op. cit.*) for field workers to record the proportion of glabrous to non-glabrous colonies, and gave some brief statistics on his and fellow workers observations in New Zealand. During my revision of Australian genera of Adiantaceae (other than *Cheilanthes*) for the 'Flora of Australia', I have examined more than 135 specimens of *Adiantum diaphanum* (including 75 from Australia) from most of the range of this species (the principal exceptions were Vietnam, China, Malaysia, Japan and Fiji). Only one herbarium specimen (Papua New Guinea, *Carr* 11943, CANB) was entirely devoid of setae. On about one-third of the remaining specimens the soral flaps were glabrous, but some (or all) pinnules bore at least one seta on their lamina. Some colonies representing the latter form (sometimes bearing only one seta on a frond) have been found in the Upper Tallebudgera valley south of Brisbane (*Bostock & McDonald* s.n., Dec 1990, BRI), in close proximity to more typically hairy plants.

The type of *Adiantum diaphanum* held at L consists of three sheets all apparently labelled as such by Blume, by comparison with his handwriting sample in van Steenis-Kruseman (1950). Sixteen separate plants are present on the sheets, and are morphologically quite similar. All individuals on the type sheets which retain their roots bear root tubers, and **all** specimens have setae on both lamina and soral flaps, albeit quite sparsely. The implication by Price that the type of *A. diaphanum* Blume has glabrous indusia is therefore erroneous.

Of 47 other Leiden Herbarium specimens I examined, all from the Malesian region, 17 were without setae on the soral flaps, although none were completely devoid of setae on the lamina. Geographically, these 47 specimens covered the major islands of Taiwan, Sumatra, Java, Timor, Flores and New Guinea. Javan specimens, excluding the type, accounted for 18 specimens of the 47, and 8 of these bear glabrous soral flaps. This is at variance with the statement by Price (*op. cit.*) that all plants from Java, the origin of Blume's type, have glabrous soral flaps. There is no justification whatsoever for using the name *A. diaphanum* Blume solely for plants with glabrous soral flaps.

Parallels to the pattern of trichome distribution in *A. diaphanum* may be found in other Australian/New Zealand species of *Adiantum*. For example, *Adiantum formosum* R. Br. exists in two forms, identical except that in one form the abaxial lamina surfaces are finely hirsute and in the other, the lamina surfaces are glabrous. Both forms bear multicellular, antrorse hairs on the adaxial surface of the rachises and petiolules. No pattern can be found in the distribution of the two forms in Australian samples. Of two New Zealand specimens seen by me, one was glabrous abaxially (Manawatu Gorge, 40°25′S, 175°45′E, Oct 1977, *Given* 10552 & *Purdie*, CANB), the other, hairy (*s. loc.*, c. 1860, ? *Hooker J.D.* [HO102726], HO).

One cultivated specimen of *Adiantum hispidulum* var. *whitei* (Bailey) P. Bostock examined (Mt Petrie, Apr 1986, *Peach* s.n., BRI) lacks hairs on the frond, except among the sporangia (a unique feature of this taxon apparently linked to the aberrant deltoid form of the lamina) (Bostock 1987). *Adiantum hispidulum* normally has a helicoid lamina bearing pale, mostly multicellular hairs on both adaxial and abaxial surfaces, including the adaxial (outer) surface of the soral flap. Two specimens of another, as yet unnamed, variant of *A. hispidulum*, from northern Australia, previously identified as *A. aethiopicum* L., are also glabrous on all surfaces, including the lamina, except for the presence of *whitei*-type setae among the sporangia (*Russell-Smith* 2661, 3916 & *Lucas*, both DNA). In addition, the holotype of *A. tenue* var. *bicolor* Domin (= *A. hispidulum* Sw.) (*Domin* 356, PR), has glabrous soral flaps and, atypically for *A. hispidulum s.l.*, very sparsely hairy lamina and rachis surfaces. Yet another form of trichome variation in *A. hispidulum s.l.*, that is, variation between taxa in the relative frequencies of occurrence of lamina hairs of different size classes, has been dealt with by Parris (1980) in her discussion of the relationship between *A. hispidulum* Sw. and *A. pubescens* Schkuhr.

Although evidence from genetic analysis techniques is lacking, e.g. from isozyme studies, the available circumstantial evidence suggests that only one (in *Adiantum diaphanum* and *A. formosum*) or a few gene loci (*Adiantum hispidulum*) are involved in the observed patterns of lamina and rachis hairs. Whether this interpretation is correct or not, I believe that it is not valid to use distribution patterns of lamina hairs, i.e.

presence/absence or numbers of hairs per mm², as a principal or indeed sole character for separation of taxa at the species level in *Adiantum*. This is particularly the case in *A. diaphanum*, which shows similar admixtures of genotypes, as expressed in the pattern of distribution of setae, in many widely separated regions. However, the morphology of lamina and rachis hairs, where these are present, is demonstrably constant and, in conjunction with other morphological features, can clearly separate the above-mentioned species of *Adiantum*.

Taxonomy

Adiantum diaphanum Blume, *Enum. pl. Javae*, fasc. 2: 215 (1828). **Type:** Linga Jattie, Java, [Oct 1824, *fide* van Steenis-Kruseman (1950)], *Blume* 649 (L 908.275-1003, 908.275-1004, 908.275-1019) (holo: L!).

Adiantum setulosum J. Smith, Comp. Bot. Mag. 72: 22 (1848). **Type:** cultivated plant, introduced in 1845 to Royal Gardens, Kew, from Norfolk Island, by Dr. McWilliam (holo: BM, *n.v.*).

Adiantum tenue var. *commutatum* Domin, Biblioth. Bot. 85: 153 (1913), **syn. nov. Type:** Picnic Creek, south of the Russell River, north Qld, 1910, *K. Domin* Iter Australiense 357 [PR 523609]. (lecto: PR! [left hand specimen, here designated; the detached frond on the right hand side is of *A. hispidulum* Sw.]).

[*Adiantum affine* auct. non Willd. (1810): Hook., Sp. fil. 2: 32 (1858); *Adiantum diaphanum* var. *affine* (Hook.) van Ald. van Ros., Malayan Ferns 323 (1908); K. Domin, Biblioth. Bot. 85: 151 (1913)].

Other synonyms may exist (for examples, see Brownsey *et al.*, 1985 and Brownsey, 1987), but they are secondary to the arguments presented here. *A. setulosum* J. Smith is considered synonymous with *A. diaphanum* Blume and rejected on the grounds of priority.

Illustrations: W.J. Hooker, Spec. fil. 2: t. 80C (1858); F.M. Bailey, Lithogr. ferns Queensland 62 (1892); Duncan and Isaac, Ferns and allied plants of Victoria, Tasmania and South Australia Fig. 13.4, 13.8, 13.10 (1986).

Roots proliferous, bearing small ± barrel-shaped tubers. Rhizome erect, tufted, c. 3 mm diameter; scales concolorous, golden-brown, with an entire margin and a prominent apical seta. Fronds tufted, to 36 cm long. Stipes to 18 cm long, smooth adaxially, scabrous abaxially. Lamina 5–18 cm long, 2–13 cm broad, subpedate, hastate or narrow-triangular, 1-pinnate, or 2- (rarely 3-) pinnate at the base and 1-pinnate above, membranous. Rachises glossy, glabrous or very rarely bearing a few setae, flexuose. Decompound basal pinnae, when present, 1–3 (rarely more), narrow-triangular, 1- or 2-pinnate. Ultimate segments dimidiate, rectangular to subtrapeziform, with shallowly lobed and often broadly-curved distal margins, becoming cuneate-flabellate in apical segments, sparsely to very sparsely setose adaxially and hirsute to sparsely setose (rarely glabrous) abaxially; setae dark brown, unicellular, acicular, straight or slightly curved. Veins dark brown near the petiole, elsewhere pale. Sori 1–10 along distal margins, usually 1 per lobe. Soral flaps orbicular to subreniform, deeply immersed in the lobe, glabrous or bearing unicellular setae similar in form to those of the lamina. Spores yellow; perine scabrous; diameter 25.6–51.9 μ (mean 33.9 μ from 25 spores measured from each of 4 specimens).

Selected specimens. Taiwan. Shakko, Dec 1913, *Faurie* 251 (L). **Borneo.** Mt Kinabalu, Dec 1913, *Clemens* 27513 & *Clemens* (L). **Sumatra.** *s. loc.*, *Korthals* [L 908.275-1015] (L). **Java.** M. Tenggen, *Zollinger* 2576 (L). **Timor.** *s. loc.*, 1882-1883, *Forbes* 3864 (L). **Flores.** Rangat (Ko) Liang, *Schmutz* F97 (L). **Moluccas.** Ceram ['Seram'], near Saunula, 3°15′S, 129°29′E, Jul 1968, *Kato* C-11397 *et al.* (L). **Bali.** Kintamani, Apr 1950, *Holstvoogd* 876 (L). **Papua New Guinea.** Koitaki, Apr 1935, *Carr* 11943 (CANB); Wau, *Croft* 661 (BRI,LAE); Kainantu, Jul 1969, *Henty* LAE72446 & *Katik* (BRI,LAE). **Australia. Queensland.** Cook District: near Cape Tribulation, 16°16′S, 145°28′E, Jun 1988, *Forster* 4376 & *Tucker* (BRI,CBG,L,NSW); SFR 675, Little Mulgrave River, 17°08′S, 145°43′E, May 1975, *Andrews* 229 & *Dockrill* (BRI). Moreton District: gully 6 km W of Landsborough, 26°48′S, 152°54′E, Mar 1986, *Bostock* 210 (BRI). **New South Wales.** Mooball, c. 1 km N of town on Pottsville Rd, 28°25′S, 153°32′E, Apr 1983, *Jones* 1003 (BRI); Norfolk Id, Mt Pitt Reserve, 29°01′S, 167°57′E, Jun 1986, *Duncan* 86088N (MEL). **Victoria.** Deadlock Ck, tributary of Tarwin R., 38°10′S, 146°00′E, Mar 1977, *Duncan* 77114 (MEL). **New Zealand.** Haruru Stream, c. 30 km NW Aukland, Rodney County, North Is., 36°34′S, 174°30′E, May 1979, *Gardner* 2417 (HO). **New Caledonia.** *s. loc.*, *s. coll.* #135 [AQ142462] (BRI).

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